FEASIBILITY STUDY

I-85
Interchange Justification Study
at SR 1103 (Central Avenue) at Butner
Granville County

I-2515

Prepared by
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The Planning and Research Branch has studied the feasibility of providing an additional interchange on I-85 at SR 1103 in Granville County (See Figure 1).

Summary

Based on a road user analysis and improved access to the area involved, the studied interchange is justifiable.

SR 1103

SR 1103 connects the Town of Butner with I-85. The route is currently grade separated from I-85 and is part of the Federal-Aid Secondary System. SR 1103 has a pavement width of 22 feet and is in good condition.

Development to the east of the studied interchange is primarily rural. To the west, development is full-density urban within the Town of Butner. A few industries are located on SR 1108 south of the NC 56 interchange.

The 1988 estimated traffic volume on SR 1103 is 1400 vehicles per day. By the year 2008 the volume is expected to increase to approximately 2300 vehicles per day without an interchange or 5500 vehicles per day with an interchange.

Currently, the Town of Butner is served indirectly by interchanges at NC 56 and US 15. Interstate traffic utilizes these interchanges and four other existing routes (SR 1102, SR 1106, SR 1100, and NC 56) to reach destinations. Each of these routes is operating below capacity. SR 1100 is a three-lane facility while the other routes are two-lane facilities.

Studied Interchange

Preliminary design studies indicate a modified diamond-type interchange would be most feasible at this location. Provision of a loop in the northwest quadrant (in lieu of a ramp in the southwest quadrant) is recommended to avoid the relocation of a service road (SR 1209).

The existing structure (Bridge No. 43), which carries SR 1103 over I-85, has a length of 274 feet and a roadway width of 34.0 feet. The structure was built in 1969 and has a sufficiency rating of 81.0. Widening of the structure is not necessary.

The total estimated cost of the interchange is approximately $1,200,000, including $1,150,000 for construction and $50,000 for right of way acquisition.

No significant environmental consequences would result from the project. No relocation of homes or businesses would be required.

Economic Analysis

Estimates of 1988 and 2008 traffic movements with and without the studied interchange are shown in Figure 2.

Applying the traffic centroids shown in Figure 1, a roaduser benefit-cost analysis yielded possible annual savings of $287,200 (see Attachment #1). The resulting benefit cost ratio of 2.4 indicates the interchange is economically justifiable.

Interchange Spacing

The studied interchange would be approximately 2.3 miles from the nearest interchange to the north (NC 56) and 3.0 miles from the nearest interchange to the south (US 15). It would be located in an area classified as rural in nature. Provision of the studied interchange would result in an average spacing of 3.5 miles. Desirable average spacing between interchanges in rural areas is 8 miles. The proposed interchange would be 2.3 miles from the nearest existing interchange. The minimum desirable spacing between interchanges in rural areas is 3 miles.

Although the spacing between interchanges would be somewhat less than desirable, no traffic operational problems are anticipated. Provision of the interchange would not interfere with Interstate traffic flow. Turning movements at adjacent interchanges would not be significantly affected except in the southwest quadrant of the NC 56 interchange where the current turning movement of 3000 VPD would decrease to 2000 VPD if the studied interchange is constructed. The existing interchanges (US 15 and NC 56) will operate below capacity throughout the planning period.

Levels of Service

Factors utilized in determining levels of service, peak-hour traffic and intersection movements in mixed traffic, and levels of service along I-85 with and without the proposed interchange are indicated on Figure 3. Also shown are turn movements and levels of service at existing unsignalized ramp terminals with US 15 and NC 56, and at the proposed ramp terminals at SR 1103 assuming stop sign control. And, levels of service assuming future signalization of all of these ramp terminals are shown.

Peak hour traffic along the existing interstate will operate at level of service (LS) F south of and at LS D north of US 15 both with and without implementation of the proposed interchange. These respective levels would be C and B if I-85 were widened to 3 thru lanes in each direction prior to the planning year.

Signalization of ramp terminals at NC 56 and the proposed interchanges would increase the level of service to C or better. Also, signalization of the ramp terminal for southbound I-85 at US 15 would increase the LS from D or E to A for all movements. It should be noted

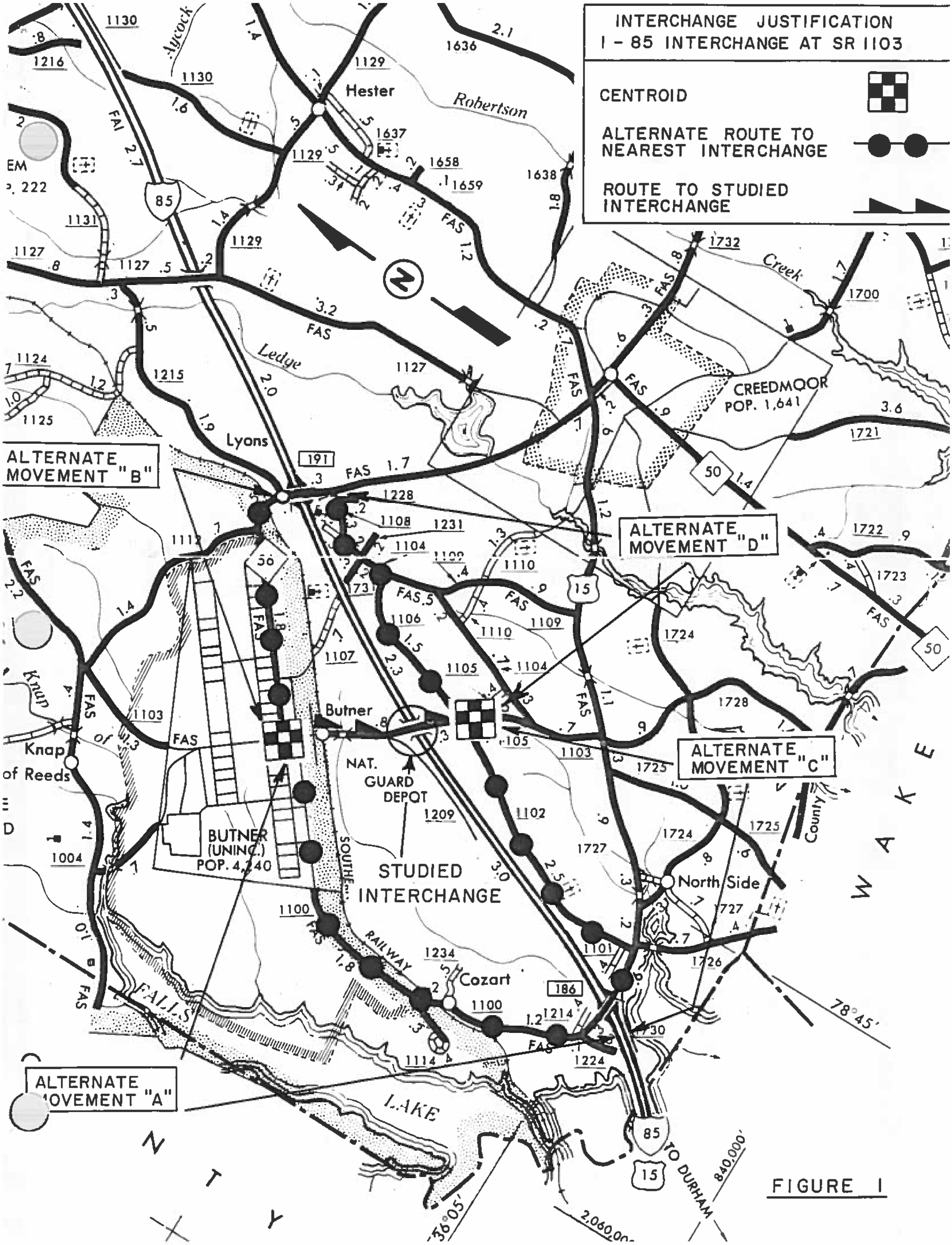
that the above described locations of signals at US 15 and at NC 56 will be required prior to the planning year to provide desirable levels of service regardless of whether or not the proposed interchange is constructed.

Conclusions and Recommendations

On the basis of a roaduser benefit cost analysis, construction of an interchange at SR 1103 is economically justifiable. The magnitude of traffic shown in Figure 2 is sufficient to warrant improved access to the area. More direct and convenient access to the Town of Butner, the John Umstead Hospital, and the previously mentioned industries will result. Although Butner is served by other area interchanges, the lack of direct access to I-85 results in substantial indirectional travel.

The estimated cost of the interchange is approximately $1,200,000.

WE/pr


INTERCHANGE JUSTIFICATION
I - 85 INTERCHANGE AT SR 1103
CENTROID
ALTERNATE ROUTE TO NEAREST INTERCHANGE
ROUTE TO STUDIED INTERCHANGE
ALTERNATE MOVEMENT "A"
ALTERNATE MOVEMENT "B"
ALTERNATE MOVEMENT "C"
ALTERNATE MOVEMENT "D"
STUDIED INTERCHANGE
Hester
Lyons
Butner
NAT. GUARD DEPOT
BUTNER (UNINC.) POP. 4,240
CREEDMOOR POP. 1,641
Knap of Reeds
Cozart
North Side
Robertson
Ledge
Creek
FALLS LAKE
WAKE
County
RAILWAY
TO DURHAM
78°45'
36°05'
840,000'
85
15
50
56
191
186
FIGURE 1

ESTIMATED TRAFFIC VOLUMES

I-85 INTERCHANGE AT SR 1103

$$\frac{\text{1988 ADT}}{\text{2008 ADT}} = \frac{00}{00} \text{ (in hundreds)}$$

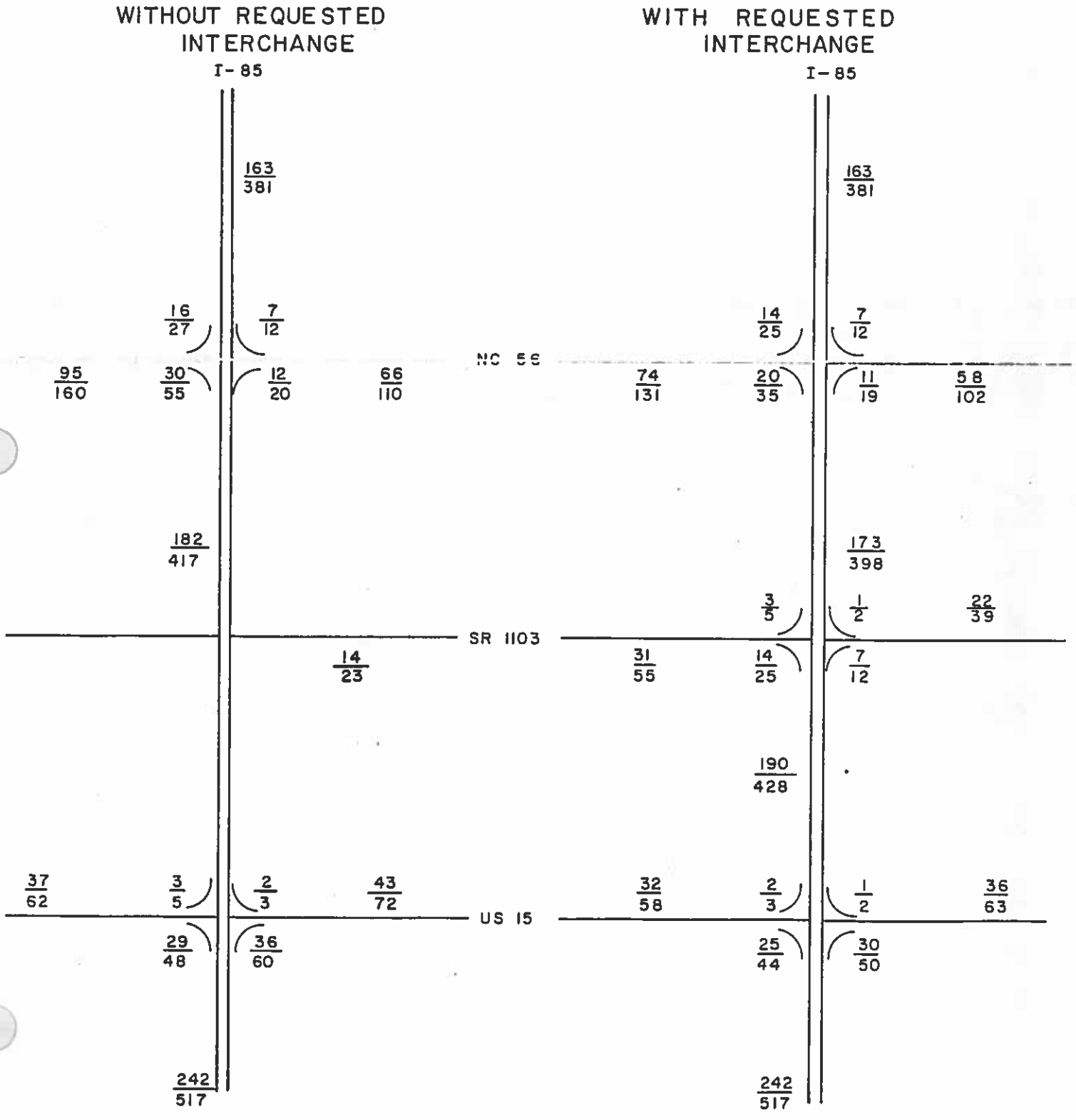
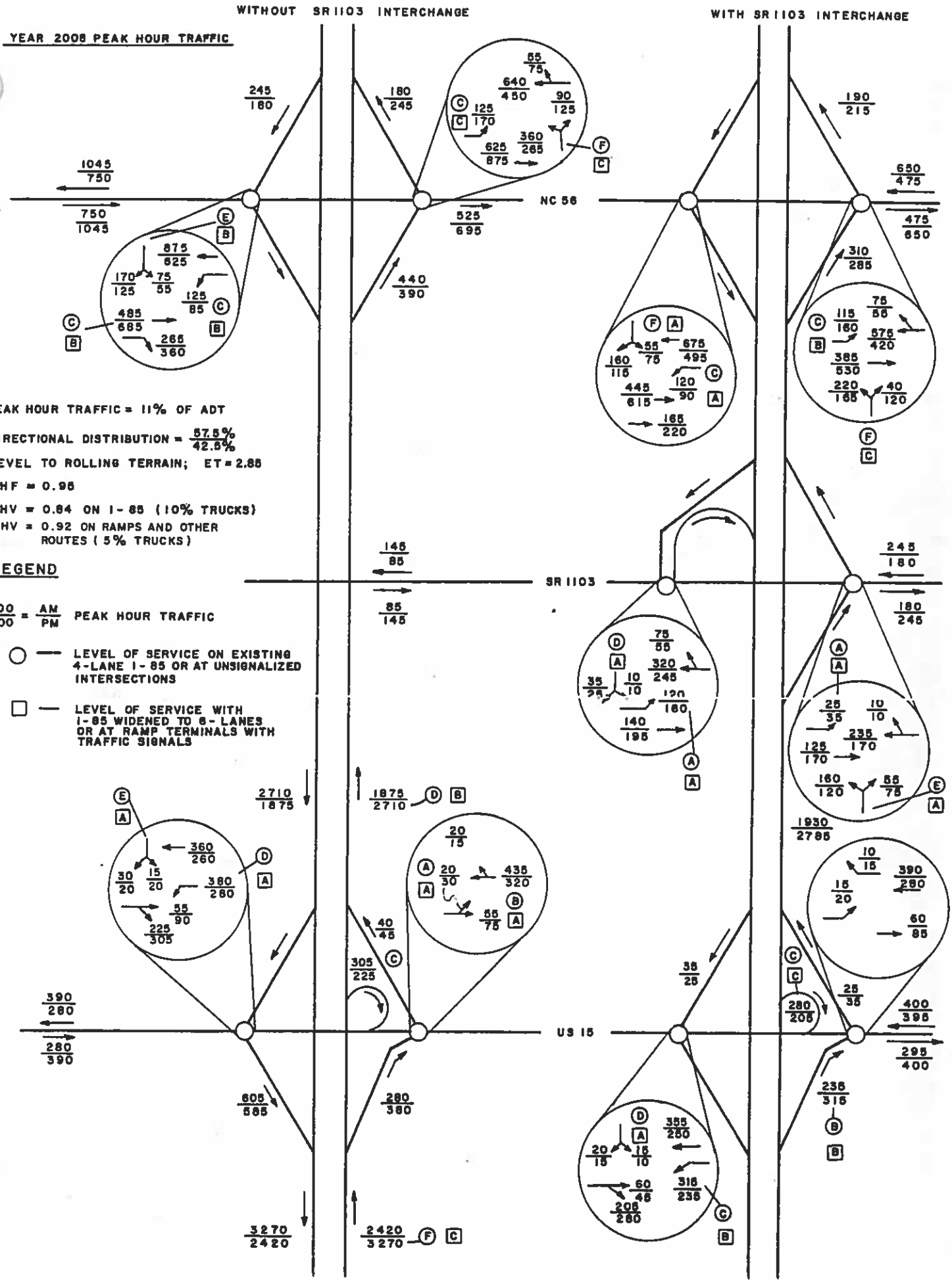


FIGURE 2

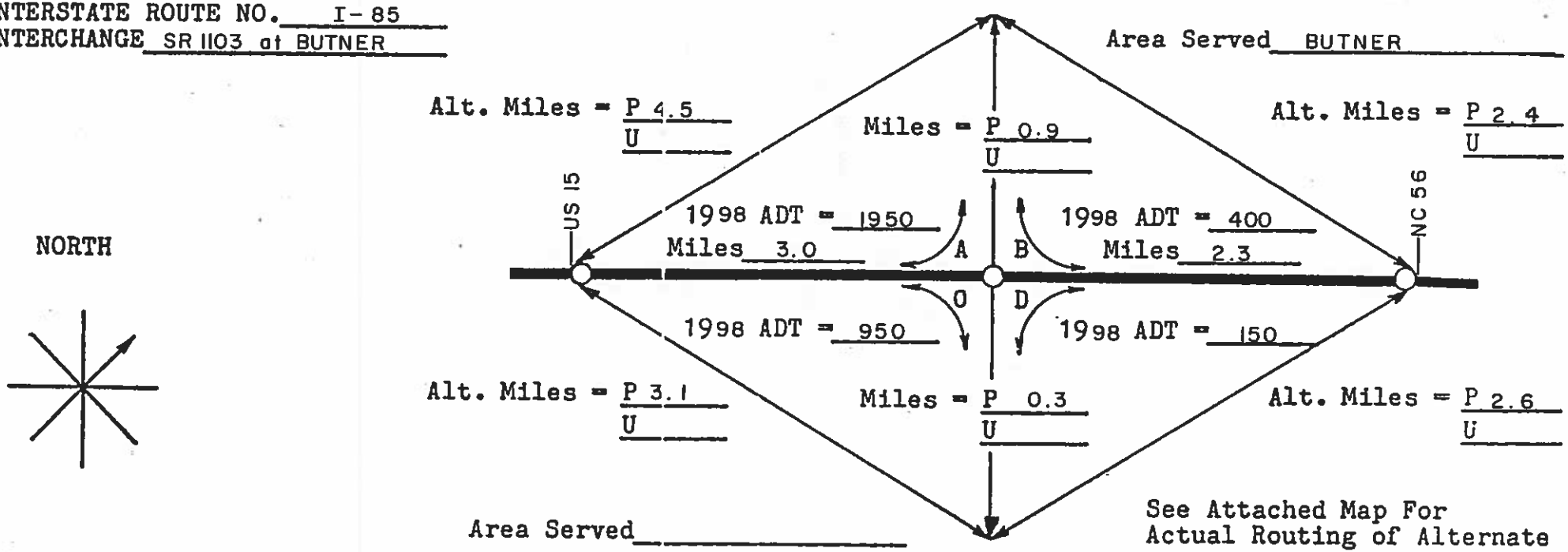
FIGURE 3


WITHOUT SR 1103 INTERCHANGE
WITH SR 1103 INTERCHANGE
YEAR 2008 PEAK HOUR TRAFFIC
NC 56
SR 1103
US 15
PEAK HOUR TRAFFIC = 11% OF ADT
DIRECTIONAL DISTRIBUTION = 57.5% / 42.5%
LEVEL TO ROLLING TERRAIN; ET = 2.88
PHF = 0.96
FHV = 0.84 ON I-85 (10% TRUCKS)
FHV = 0.92 ON RAMPS AND OTHER ROUTES (5% TRUCKS)
LEGEND
AM / PM PEAK HOUR TRAFFIC
LEVEL OF SERVICE ON EXISTING 4-LANE I-85 OR AT UNSIGNALIZED INTERSECTIONS
LEVEL OF SERVICE WITH I-85 WIDENED TO 6-LANES OR AT RAMP TERMINALS WITH TRAFFIC SIGNALS

ATTACHMENT NO. 1

WORKSHEET FOR DETERMINING BENEFIT-COST RATIO

INTERSTATE ROUTE NO. I-85
INTERCHANGE SR 1103 at BUTNER



ROAD USER SAVINGS = (FJ + GK) + (HR) - (EL + FM + GN) (PQ):
Refer to Procedure For Discussion of Formula Factors

Quadrant	Without Interchange F	J	G	K	H	R	With Interchange E	L	F	M	G	N	Q	P	Road User Savings
A =	(.30x	4.5	+.14x		)+(.07x	0.5	)-(.30x	0.9	+.26x	3.0	+.14x		)	(365)	(1950)	= $238,400
B =	(.30x	2.4	+.14x		)+(.07x	0.5	)-(.30x	0.9	+.26x	2.3	+.14x		)	(365)	(400)	= $ NEGATIVE
C =	(.30x	3.1	+.14x		)+(.07x	0.75	)-(.30x	0.3	+.26x	3.0	+.14x		)	(365)	(950)	= $ 39,000
D =	(.30x	2.6	+.14x		)+(.07x	1.25	)-(.30x	0.3	+.26x	2.3	+.14x		)	(365)	(150)	= $ 9,800

Algebraic sum of annual road user savings = $ 287,200

Cost of providing ramps = $ 1,200,000

Annual capitalization and maintenance cost ($ 1,200,000 x 0.10) = $ 120,000

Interchange benefit-cost ratio = 2.4

The interchange is [X] is not [ ] justified based upon benefit-cost ratio

ATTACHMENT No. 2

INTERCHANGE JUSTIFICATION SUMMARY

Route No. I-85 Proposed Interchange SR1103 at BUTNER

Section: SR 1637 (DURHAM Co.) TO SR 1135 (GRANVILLE Co.)

Section Length 13.9 Mi. Area Classification RURAL

Average Interchange Spacing in Section 3.5 Mi.; Desirable 8.0 Mi.

Distance to Nearest Interchange in Area 2.3 Mi.; Desirable 3.0 Mi.

Description of Crossroads:

System: N. C. Major Arterial ☐ Minor Arterial ☐ Collector ☐

F.A.P. ☐ F.A.S. ☒ F.A.U. ☐ State ☐ Other ____

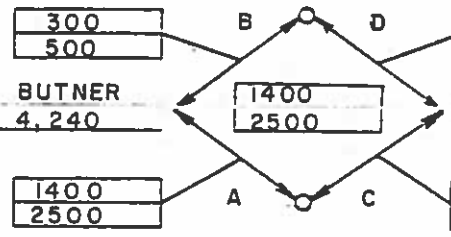
Condition: Paved ☒ Unpaved ☐

No. of Lanes: Existing 2 Future 2

Grade Separation Would ☒ Would not ☐ Exist without Ramps

Interchange ADT Traffic and Environment

2.3 Mi. to Interchange AT NC 56



0.8 Mi. to: BUTNER Pop. 4,240

Mi. to: ____ Pop. ____

3.0 Mi. to Interchange AT US 15

This Interchange Does not ☒ Does ☐ Create Abnormal Interference with Freeway Traffic

Parallel Routes Adequate ☐ Inadequate ☒

Economically Improvable Yes ☒ No ☐

Summary of Benefit-Cost Ratio

Cost of Providing Interchange 1,200,000

Interchange Benefit-Cost Ratio 2.4

Interchange is Justified Yes ☒ No ☐

Support for Determination:

Spacing	Adequate	☐	Inadequate	☒
Route Classification	Major	☐	Minor	☒
Traffic Need	Evident	☒	Not evident	☐
Traffic Operation	Not Impaired	☒	Impaired	☐
Alternative Routes	Inadequate	☒	Adequate	☐
Benefit Cost Ratio	Favorable	☒	Unfavorable	☐

Other ____